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March 26, 1868.

Lieut.-General SABINE, President, in the Chair.

Pursuant to notice given at the last Meeting, Theodor Ludwig Wilhelm Bischoff of Munich, Rudolph J. E. Clausius of Würzburg, Samuel Heinrich Schwabe of Dessau, and Hugo von Mohl of Tübingen, were balloted for, and elected Foreign Members of the Society.

The following communication was read :—

“On the Amount and Changes of the Polar Magnetism at certain positions in Her Majesty’s Iron-built and Armour-plated Ship ‘Northumberland.’” By FREDERICK JOHN EVANS, F.R.S., Staff-Captain R.N., in charge of the Admiralty Magnetic Department. Communicated with the sanction of the Lords Commissioners of the Admiralty. Received March 5, 1868.

(Abstract.)

The ‘Northumberland’ is a ship of 6621 tons, built at Millwall, River Thames; head N.  $39\frac{1}{2}^{\circ}$  E. magnetic, and completed with the armour-plates in the same direction: the launch was effected on 17th April 1866; she then lay for eight months in the Victoria Docks, head S.  $22^{\circ}$  W. magnetic, or in a direction nearly opposite to that occupied in building.

From January to March 1867 she lay at Sheerness swinging to wind and tide: the ship was then removed to Devonport and placed in dry dock, head S.  $84^{\circ}$  E. magnetic, where she has remained till the present time. Observations of deviation and horizontal and vertical force were made at the standard compass (elevated  $8\frac{3}{4}$  feet from the iron deck, and 172 feet distant from the stern), the poop-, and two steering-compasses (starboard and port), the latter being on the quarter-deck below the poop-compass,—the group being placed near the steering-wheel, 52 feet from the stern, and each compass 4 feet above its own deck.

The polar force at each compass was originally directed to the part of the ship which was south in building; it diminished in the Victoria Docks, showed a tendency to return to its original value at Sheerness; and finally a large force to starboard was developed by the position of the ship in dock for the lengthened period at Devonport.

Tables are appended giving the magnetic coefficients for each compass from time to time, extending from 17th April 1866 to 10th December 1867.

The results show that the greater part of the polar magnetism was caused by the subpermanent magnetism of the *whole mass of the ship*, due to her position in building and afterwards: this polar force was so great as to require correction by magnets in addition to the usual tabular corrections.

The 'Northumberland' was the subject of a singular attempt to "depolarize" her, by the Patentee of a process "for an improved method of correcting the deviation of compasses in iron ships"\*.

The attempt was made—first, on the 4th August 1866, in Victoria Docks, by moving electromagnets over the external plates of the ship, but without effect; next at Sheerness, in January 1867—a similar process without effect; then by applying electromagnets to the beams of the poop-deck, in immediate proximity to the poop- and two steering-compasses, and with considerable effect, as a powerful north pole of a subpermanent quality was developed in the centre of those beams (about 5 feet abaft the compasses), producing a repulsive force on the poop- and steering-compasses amounting nearly to two-thirds of the earth's force.

By this the semicircular deviation of the poop and port steering-compasses was reduced to  $\frac{1}{4}$  of its original amount, returning, however, in the course of a year (eleven months), as determined by observations made in June, August, and December 1867, to  $\frac{3}{4}$  of its original amount. The deviation of the starboard steering-compass was altered slightly in amount, and largely in direction; but is now, in common with that of the two compasses just named, gradually returning to its original state.

The deviation of the standard compass was not affected by the operations in the slightest degree.

The "heeling" deviation of the poop-compass was affected in nearly the same way as its semicircular deviation: the "heeling" deviation of the starboard steering-compass was *increased*; but the *increase*, like the decrease of the poop-compass, was fast disappearing in December 1867.

The correction by the "depolarizing" or "demagnetizing" process was therefore both imperfect and transient, and productive of more injury than benefit; in consequence of which the author has submitted to the Admiralty that no so-called "depolarization" should be allowed within 20 feet of any compass placed for the navigation of the ship.

\* A full account of this "depolarizing" process, with the general views of the patentee, will be found embodied in two papers read before the Royal United Service Institution, and the discussions thereon, as published in the Journal of the Institution:—the first paper, on "Terrestrial Magnetism with reference to the Compasses of Iron Ships; their deviation and remedies," read January 29th, 1866; the second paper, on "The Demagnetization of Iron Ships, and of the iron beams &c. of wooden vessels, to prevent the deviation of the compasses, &c.," read May 6th, 1867,—both papers by Evan Hopkins, Esq., C.E., F.G.S.